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Parasitoids Associated with Whiteflies (Homoptera: Aleyrodidae) in Hispaniola and Descriptions of Two New Species of *Encarsia* Förster (Hymenoptera: Aphelinidae)

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Abstract.—Geographic distribution, host range information and an illustrated key to species (in English and Spanish) of parasitoids associated with whitefly species on the island of Hispaniola are provided. Two **new species, *Encarsia dominicana* Evans,** reared from *Aleurothrixus floccosus* in the Dominican Republic and Florida (USA), and ***Encarsia telemachusi* Evans,** reared from an aleyrodid in Haiti, are described and illustrated. Eight new distribution records and two new hosts records are reported for parasitoids reared from whiteflies in the Dominican Republic.

The island of Hispaniola, located in the northern Caribbean Basin, spans nearly 30,000 square miles and is comprised of two countries, the Dominican Republic that covers the eastern two-thirds, and Haiti that covers the western third of the island. Whiteflies attack several agricultural crops grown on the island including field beans, lima beans, cowpea, tomatoes, eggplant, sweet pepper, cucumbers, cantaloupe, watermelon, okra, tobacco, ornamentals, citrus, cassava, cocoyam, palm, banana and others (Serra *et al.* 1996, Donis and Prophete 1997). More than 20 whitefly species have been detected in the Dominican Republic, most of which appear to be associated with a narrow spectrum of plant hosts and rarely cause economic damage to crops. The *Bemisia tabaci* complex in the lowlands and *Trialeurodes vaporariorum* (Westwood) in the mountain valleys are the only whitefly species that are considered to be key pests, particularly in vegetable crops (Serra *et al.* 1996).

Whitefly-transmitted plant viruses cause major economic losses to various crops on the island. The bean mosaic virus, transmitted by the *B. tabaci* complex, has been reported in both countries since the 1970s. In 1988, *Bemisia argentifolii* Perring and Bellows (or *Bemisia tabaci* biotype B) invaded the island and has caused severe damage to tomatoes by direct feeding, inducing uneven ripening (a phytotoxic disorder), and the transmission of the *Bemisia-geminivirus* complex The damage caused by whitefly in terms of loss of crop quality and quantity ranged from 20 and 95% from 1988 to 1994 (Alvarez and Abud-Antun 1997). No reliable or statistical data are available for Haiti, but losses associated with the *Bemisia-geminivirus* complex on tomatoes are known to have occurred.

In 1995, tomato growers in the Dominican Republic began to implement improved, integrated management practices including a 3-month host-free period, protected seedbeds, systemic and selective insecticide applications and tolerant and resistant varieties. Due to these measures and increased activity by biological control agents and climatic factors (periods of drought and heavy rainfall), whitefly populations reached an equilibrium at a relatively low level at the beginning of the

1995 season, and growers were able to produce a profitable crop.

As the whitefly population increased later in the season, mass production and inundative release of whitefly parasitoids was discussed as a strategy to stablize the situation. However, prior to introducing selected exotic parasitoids, it was considered essential to identify the parasitoid species already present in the region and their relative importance. In 1995, a survey of the whitefly species and their endemic and introduced natural enemies was initiated by C. Serra and collaborators at the Instituto Superior de Agricultura (Santiago) in the main production areas of various crops attacked by whiteflies in the Dominican Republic. The goals of survey were to identify the parasitoid species that attack whitefly in the most important agricultural areas in the Dominican Republic, and gather information on their hosts and distribution and relative importance. Laboratory studies were conducted on the biology of certain parasitoid species. In addition to these collections, we have included records of *Encarsia*, *Eretmocerus* and *Signiphora* species collected by Sabine Tappertrzhofen in yellow pan traps in southern area of the Dominican Republic (from San Cristoban to Azua).

Very little prior knowledge exists regarding the species of whitefly parasitoids that occur on the island. Dozier described *Encarsia catherinae* and *Encarsia haitiensis* (Dozier 1932a) and *Eretmocerus pallidus* (Dozier 1932b) from Haiti. He reported *Encarsia cubensis* Gahan and *Encarsia variegata* Howard (Dozier 1933), *Eretmocerus paulistis* Hempel (misidentification) (Dozier 1932b) and *Eretmocerus serius* Silvestri (Dozier 1932c) from Haiti. Polaszek *et al.* (1992) reported *Encarsia hispida* and Serra (1992) reported *Encarsia nigricephala* from Dominican Republic. An asterisk is placed before records representing new host and/or distribution records. A host/parasitoid list is given at the end (Table 1).

KEY TO PARASITOIDS ASSOCIATED WITH WHITEFLIES IN HISPANIOLA

1. Fore wing with marginal and stigmal veins absent; pronotum reaching tegula; body entirely black and heavily sclerotized; female antennal flagellum 8-segmented (Fig. 5), consisting of 5 funicle segments and 3-segmented compact club. Male antennal flagellum with 7 funicle segments and one club segment, F2 with tongue-shaped sensory organ (genus *Amitus*); 1 species known from Hispaniola with fore wing infuscate, and flagellum dark brown with F1 and F2 very elongate and club short with a rounded apex; *ex Trialeurodes vaporariorum*, Dominican Republic ..... ***Amitus fuscipennis* MacGown and Nebeker**

1′ Fore wing with marginal and stigmal veins present, pronotum separated from tegula by prepectus, body not entirely black and heavily sclerotized (Chalcidoidea), male and female flagellum with 6 or fewer segments 2

2 (1) All tarsi 4-segmented 3

2′ All tarsi usually 5-segmented, rarely middle leg with 4-segmented tarsus (Fig. 19) ... 7

3 (2) Fore wing narrow (Fig. 16), disk length 2× maximum disk width with a row of setae along the wing margin and 1–2 rows transversing the disk; antennal flagellum (Fig. 13) consisting of 2 funicle (one transverse and one cylindrical) and 1 elongate club segment; male antennal flagellum (Fig. 12) with 1 funicle and 1 elongate club segment ..... ***Cales noacki* Howard**

3′ Fore wing broad, disk length approximately as long as maximum disk width and with many setae evenly distributed throughout disk; antennal flagellum variable ... 4

4 (3′) Antennal flagellum 6-segmented consisting of 2 minute anelli, 1 cylindrical funicle segment, and 3-segmented club (Fig. 6); scutellum with 1 pair of setae; stigmal vein elongate (Fig. 20), body yellow with transverse bands on gastral tergites IV–VI; male

antennal and fore wing characters similar to that of female ..... *Neopomphale aleurothrixi* **(Dozier)**

4′ Antennal flagellum 3-segmented consisting of 2 short funicle segments and 1 elongate club segment (Fig. 7); scutellum with 2 pairs of setae; stigmal vein not as elongate as that of *Neopomphale*; body yellowish; male antennal flagellum consisting of 1 very elongate club segment (Fig. 8) ..... *Eretmocerus*. 5

5 (4′) F1 very narrow (annelliform), F2 short and triangular; club 5–6× as long as wide, fore wing setae sparse with 1 row of setae under marginal vein; midlobe with 3 pairs of setae ..... *E. serius* **Silvestri**

5′ F1 triangular, F2 transverse or quadrate, club 4.0–7.4× as long as wide, forewing setae more dense with more than 1 row of setae under marginal vein; midlobe with 3 pairs of setae 6

6 (5′) Antennal club length less than 6× width; dorsal surface of club convex contrasting with straight ventral surface; F2 triangular ..... *E. portoricensis* **Dozier**

6′ Antennal club 7.3–7.4× as long as wide; dorsal and ventral surfaces of club more or less parallel; F2 transverse ..... *E. pallidus* **Dozier**

7 (2′) Antennal flagellum 4-segmented consisting of 3 transverse funicle segments and 1 elongate club (Fig. 9, 10); fore wing disk asetose and; scutellum rectangular, width at least 42 its length (Fig. 17); male antenna (Fig. 11) similar to that of female; hyperparasitoids ..... *Signiphora* 8

7′ Antennal flagellum 6-segmented, consisting of 3–4 funicle segments and 2–3 club segments, apical segment not greatly elongate (Fig. 4), forewing disk setose; scutellum oval, less than 2× its width; male antennal flagellum with 5–6 segments; female primary parasitoids and male hyperparasitoids ..... *Eucarsia* 9

8 (7) Gaster yellow with dark brown, transverse bands on tergites II–IV; head yellow with foramen dark brown; forewing with a dark brown band under the marginal vein (Fig. 15) club 4.1× as long as wide (Fig. 9) ..... *S. aleyrodis* **Ashmead**

8′ Gaster dark brown with tergite VI and VII yellowish; head dark brown; forewing with a dark brown band under the marginal vein (Fig. 15); club 3.4× as long as wide (Fig. 10) ..... *S. townsendi* **Ashmead**

9 (7′) Tarsus of middle leg 4-segmented (apical 2 segments partially fused as in Fig. 19) 10

9′ Tarsus of middle leg 5-segmented (as in Fig. 2) 15

10 (9) Fore wing with asetose area around stigmal vein; F2 of male antenna with round sensorial/glandular process (in species where males are known) ..... ***E. cubensis* group** 11

10′ Fore wing without an asetose area around stigmal vein; F2 of male antenna without round sensorial/glandular process ..... ***E. luteola* group** 12

11 (13) Body yellow with head and anterior ⅓–½ of mesoscutum dark brown; midlobe with 2 pairs of setae ..... *E. nigricephala* **Dozier**

11′ Body dark brown with yellow scutellum and central area on gastral tergites I and II; midlobe with 2 pairs of setae ..... *E. cubensis* **Gahan**

12 (10′) Head and mesosoma dark brown; gaster yellow with anterior margin of tergite I dark brown, or gaster yellow with dark brown lateral margins 13

12′ Head and mesosoma entirely yellow or slightly infuscate 14

13 (12) Gaster completely yellow (except dark brown base), F1 cylindrical, 0.7× as long as F2; midlobe with 8–10 pairs of setae ..... *E. formosa* **Gahan**

13′ Gaster yellow with dark brown lateral margins, F1 quadrate, 0.5× as long as F2; midlobe usually with 8 pairs of setae ..... *E. variegata* **Howard**

14 (12′) F1 quadrate, about 0.5× F2; F2 subequal to F3; F6 slightly longer than F5; midlobe with 6 pairs of setae ..... *E. haitiensis* **Dozier**

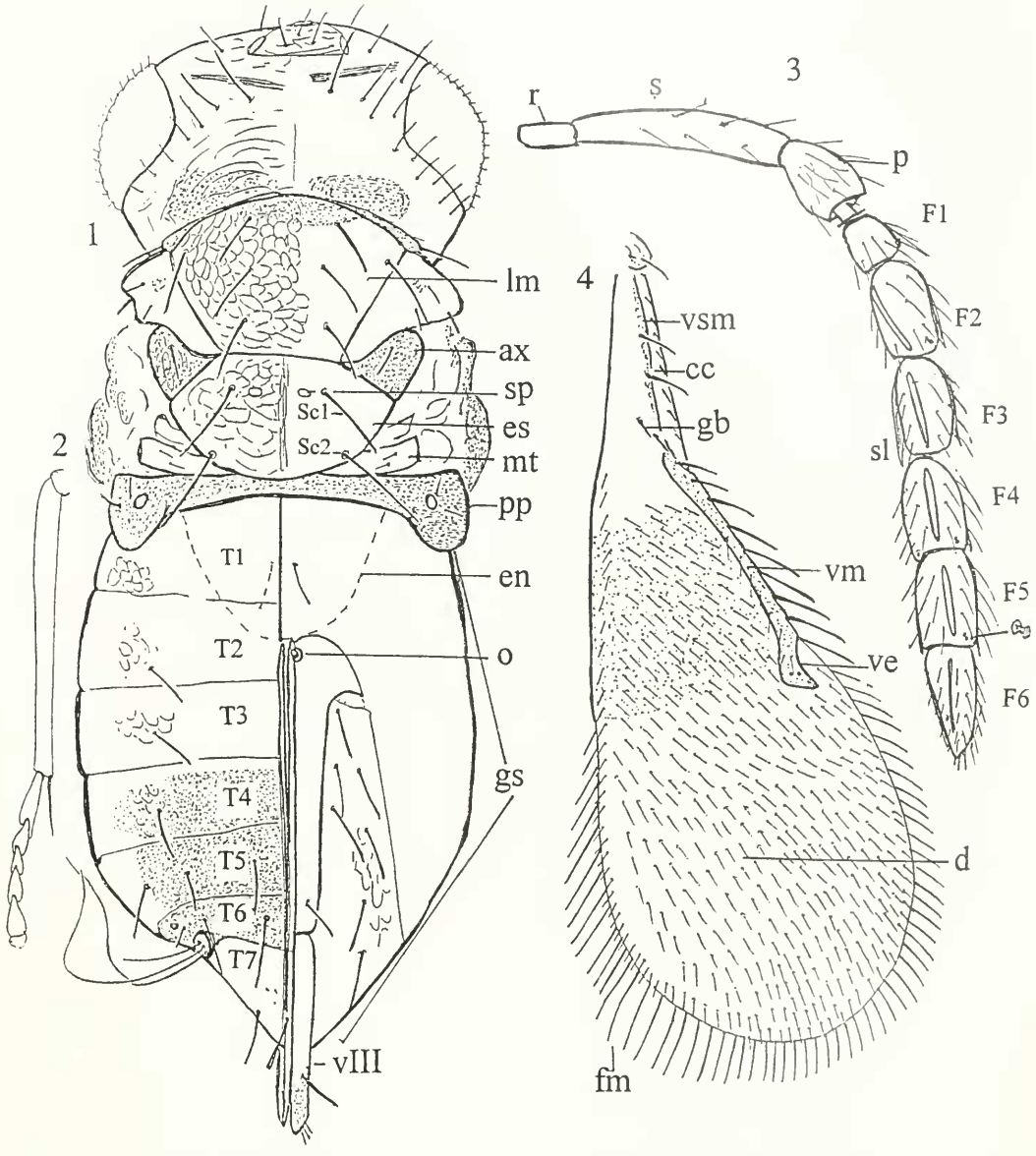
14′ F1 cylindrical, about 0.7× F2; F2 intermediate in length to F1 and F3; F6 very elongate, about 1.2× F5; midlobe usually with 4 pairs of setae ..... *E. hispida* **De Santis**

15 (9′) Fore wing with large asetose area around stigmal vein .... ***E. parvella* group** 16

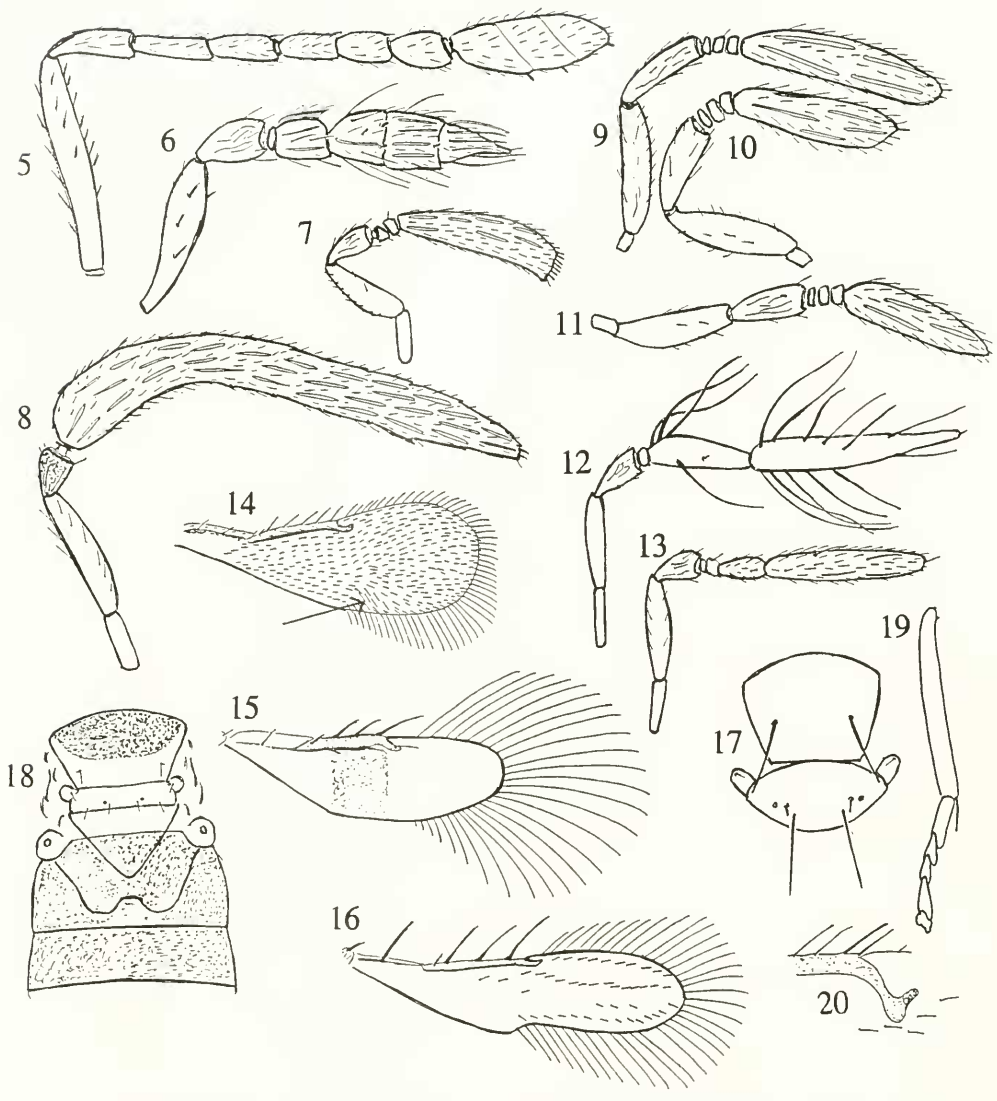
15′ Fore wing without large asetose area under stigmal vein 18
16 (15) Gaster yellow with transverse, dark brown bands on tergites I, V and VI; apical setae of valvulae III lanceolate; midlobe with 2 pairs of setae ..... ***E. lanceolata* Evans and Polaszek**
16′ Gaster completely yellow or dark brown with yellow lateral margins, TVII and venter; apical setae of valvulae III setiform; midlobe with 4–5 pairs of setae 17
17 (16′) Body usually with large dark brown inverted triangle on midlobe and gaster dark brown with yellow lateral margins, TVII and venter (dark form), body sometimes completely yellow (light form); fore wing infuscate under marginal vein; F5 distinctly (1.2×) longer than F4; F6 very elongate and much longer than F5 ..... ***E. tabacivora* Viggiani**
17′ Body bright yellow; fore wing hyaline; F5 slightly longer than F4 and slightly shorter than F6 ..... ***E. telamachusi* Evans, new species**
18 (15′) Body completely yellow, placoid sensillae on scutellum closer than diameter of one sensillum; fore wing disk with evident area of long setae (Fig. 14); midlobe usually with 4 pairs of setae (sometimes 3 or 5 pairs) ..... ***E. sophia* (Girault and Dodd)**
18′ Body at least partially dark brown, distance between placoid sensillae variable; fore wing setae uniform; midlobe with 4 pairs of setae 19
19 (18′) F1 cylindrical, 0.7× F2; distance between placoid sensillae on scutellum less than diameter of one sensillum; mesoscutum with 4 pairs of setae; gaster dark brown .. 20
19′ F1 quadrate (Fig. 1), placoid sensillae on scutellum at least 2.5× diameter of one sensillum apart, gaster yellow with some dark brown tergites 21
20 (19) Antennae unicolorous, fore wing hyaline, base of gastral tergite VI exceptionally broad ..... ***E. portoricensis* Howard**
20′ Antennae yellow with F5 and F6 dark brown; fore wing infuscate under marginal vein; gastral tergite VI not exceptionally broad ..... ***E. catherinae* (Dozier)**
21 (19′) Gaster yellow with dark brown tergites IV–VI, F1 quadrate; Sc1 elongate, slightly shorter than Sc2 (Fig. 1–4) ..... ***E. dominicana* Evans, new species**
21′ Gaster yellow with posterior edge of tergite II to VI dark brown, F1 transverse; Sc1 short, less than 0.5× Sc2 ..... ***E. perplexa* Huang and Polaszek**

CLAVE DE LOS PARÁSITOS ASOCIADOS CON ALEIRODIDOS EN LA HISPANIOLA

1 Ala anterior sin vena (=nervadura) marginal ni vena estigmática; pronoto tocando la tégula; cuerpo completamente negro y bastante esclerotizado; flagelo de la hembra de 8 segmentos (5 segmentos de funículo, clava compacta y de 3 segmentos); flagelo del macho de 8 segmentos (7 de funículo y 1 de clava), F2 con un órgano sensorial (Genero *Amitus*); 1 especie conocida en la Hispaniola con el ala anterior ahumada, el flagelo café obscuro y F1 y F2 más elongados, y la clava corta con el ápice redondo ..... ***Amitus fuscipennis* MacGown and Nebeker**
1′ Ala anterior con vena marginal y vena estigmática (aunque muy corta en algunas especies); pronoto separado de la tégula por el prepecto; cuerpo raramente completamente negro (no en las especies en Hispaniola) o muy esclerotizado (Chalcidoidea) 2
2 (1′) Todos los tarsos de 4 segmentos 3
2′ Todos los tarsos usualmente de 5 segmentos, raramente el tarso del segundo par de patas con 4 segmentos (Fig. 19) 7
3 (2) Ala anterior estrecha (Fig. 16), longitud del disco 2× el ancho, y con una fila de setas por el margin del ala y 1–2 filas atravesando el disco; flagelo (Fig. 13) con 2 segmentos de funículo (1 transverso y otro cilíndrico) y 1 segmento muy alargado de la clava;



Figs. 1–4. *Encarsia dominicana*, female. 1, Habitus, mesosoma divided medially with surface sculpture shown on left side; gaster divided medially with dorsal side shown on left side and venter on right. 2, Tibia and tarsus, leg II. 3, Antenna. 4, Fore wing. Abbreviations: (ax) axilla, (cc), costal cell, (d) disk, (en) endophragma, (es) scutellum, (F1–F6) funicle segments 1–6; (fl) flagellum, (fm) marginal fringe, (gb) basal group, (gs) gaster, (lm) median lobe, (me) mesoscutellum, (mt) metanotum, (o) ovipositor, (p) pedicel, (pp) propodeum, (r) radicle, (s) scape, (Sc1) anterior scutellar setae, (Sc2) posterior scutellar setae, (sl) linear sensillae, (sp) placoid sensillae, (ve) stigmal vein, (vm) marginal marginal, (vsm) submarginal vein, (vIII) valvulae III.



Figs. 5–20. 5–13, Antenna. 5, *Amitus fuscipennis* ♀. 6, *Neopomphale aleurothrixi* ♀. 7, *Eretmocerus* sp. ♀. 8, *Eretmocerus* sp. ♂. 9, *Signiphora aleyrodis* ♀. 10, *Signiphora townsendi* ♀. 11, *S. townsendi* ♂. 12, *Cales noacki* ♂. 13, *C. noacki* ♀. 14–16, Fore wing. 14, *Encarsia sophia* ♀. 15, *S. aleyrodis* ♀. 16, *C. noacki* ♀. 17, *C. noacki* mesosoma ♀. 18, *S. aleyrodis* mesosoma and gastral tergites I–II ♀. 19, *Encarsia nigricephala* tibia and tarsus II ♀. 20, *N. aleurothrixi* stigmal vein ♀.

el flagelo de macho (Fig. 12) con 1 segmento de funículo y 1 segmento muy alargado de la clava ..... ***Cales noacki* Howard**

3′ Ala anterior ancha, longitud del disco aproximadamente tan largo como ancho y con muchas setas distribuídas uniformemente a través del disco; flagelo variable 4

4 (3′) Flagelo de 6 segmentos (2 segmentos de anelli transversos, 1 segmento de funículo cilíndrico, clava de 3 segmentos (Fig. 6); escutelo con 1 par de setas; vena estigmática elongada (Fig. 20), cuerpo de color amarillo con bandas café sobre los terguitos abdominales IV–VI ; flagelo y alas del macho similar a los de la hembra .... ***Neopomphale aleurothrixi* (Dozier)**

4′ Flagelo de 3 segmentos (2 funículo segmentos cortos y clava de 1 segmento elongado) (Fig. 7); escutelo con 2 pares de setas; vena estigmática no tan larga como en *Neopomphale*; color del cuerpo amarillo ó anarajando; flagelo del macho con 1 segmento muy elongado en la clava (Fig. 8) ..... *Eretmocerus* 5

5 (4′) F1 muy estrecho (aneliforme), F2 corto y triangular, longitud de la clava 5–6× más largo que ancho, setas del ala anterior muy escasos con una sola fila de setas debajo de la vena marginal ..... ***E. serius* Silvestri**

5′ F1 más ancho y triangular, F2 transverso o cuadrado, clava 4.0–7.4 más larga que ancha, setas del ala anterior más densas con más de una fila de setas debajo de la vena marginal 6

6 (6′) Longitud de la clava menos de 6× del ancho; clava con la superficie dorsal convexa, y la superficie ventral recta; F2 triangular ..... ***E. portoricensis* Dozier**

6′ Longitud de la clava 7.3–7.4× más larga que ancha con las superficies dorsal y ventral más o menos planas; F2 transverso ..... ***E. pallidus* Dozier**

7 (2′) Flagelo con 4 segmentos (3 segmentos del funículo transversos y 1 segmento de clava muy elongado) (Fig. 9, 10); disco del ala anterior sin setas y con una banda de color café debajo de la vena marginal (Fig. 15); escutelo rectangular, por lo menos 4× más ancho que largo (Fig. 17); antena del macho (Fig. 11) parecida a la de la hembra; hiperparasitoides ..... ***Signiphora*** 8

7′ Flagelo de 6 segmentos (3–4 segmentos de funículo y 2–3 segmentos en la clava), con el último segmento no muy elongado (Fig. 4), ala hialina o ahumada; escutelo oval, menos de 2× más ancho que largo; flagelo del macho con 5–6 segmentos; las hembras son parasitoides primarios y los machos casi siempre son hiperparasitoides ..... ***Encarsia*** 9

8 (7) Gáster amarillo con bandas café atravesando los terguitos II–IV; cabeza amarilla con el foramen café obscuro; clava 4.1× más larga que ancha (Fig. 9) ..... ***S. aleyrodis* Ashmead**

8′ Gáster café obscuro con terguitos VI and VII amarillos; cabeza café obscura; clava 3.4× más larga que ancha (Fig. 10) ..... ***S. townsendi* Ashmead**

9 (7′) Tarso del segundo par de patas de 4 segmentos (los 2 segmentos apicales parcialmente unidos) como en la figura 19 10

9′ Tarso del segundo par de patas de 5 segmentos como en la figura 2 15

10 (9) Ala anterior con un área sin setas alrededor de la vena estigmática; F2 del macho con un proceso sensorial/glandular redondo (en las especies en que el macho es conocido) ..... **Grupo de especies *E. cubensis*** 11

10′ Ala anterior con el área alrededor de la vena estigmática con setas uniformes; F2 del macho sin un proceso sensorial/glandular redondo. ..... **Grupo de especies *E. luteola*** 12

11 (10) Cuerpo amarillo con la cabeza y el anterior 0.3–0.5 parte del mesoescudo café obscuro; lóbulo mediano de mesoescudo con 2 pares de setas ..... ***E. nigricephala* Dozier**

11′ Cuerpo café obscuro con el escutelo y el área central de terguitos abdominales I y II amarillos; lóbulo mediano de mesoescudo con 2 pares de setas .... ***E. cubensis* Gahan**

12 (11′) Cabeza y tórax de color café oscuro; abdomen amarillo con el margen anterior del tergito I café obscuro, o abdomen amarillo con los lados laterales café 13

12′ Cabeza y tórax completamente amarillas o un poco ahumados 14

13 (12) Abdomen completamente amarillo (menos en la base que es café obscuro), F1 cilíndrico y 0.7× de la longitud de F2; lóbulo mediano de mesoescudo con 8–10 pares de setas ..... ***E. formosa* Gahan**

13′ Abdomen amarillo con márgenes laterales café; F1 cuadrado y 0.5× de longitud del F2; lóbulo mediano de mesoescudo usualmente con 8 pares de setas ..... ***E. variegata* Howard**

14 (12′) F1 cuadrado, aproximadamente 0.5× de la longitud del F2; F2 tan largo que F3; F6

un poco más largo que F5; Lóbulo mediano de mesoescudo con 6 pares de setas . . . . . ***E. haitiensis* Dozier**

14′ F1 cilíndrico, aproximadamente 0.7× de la longitud del F2; longitud de F2 entre el largo de F1 y F3; F6 muy elongado, como 1.2× de la longitud de F5; lóbulo mediano de mesoescudo usualmente con 4 pares de setas (a veces 3 o 5 pares) . . . . . ***E. hispida* De Santis**

15 (9′) Ala anterior con una área grande sin setas alrededor de la vena estigmática . . . . . **Grupo de especies *E. parvella*** 16

15′ Ala anterior con setas uniformes alrededor de la vena estigmática 18

16 (15) Abdomen amarillo con bandas tranversas café obscuro sobre I, V y VI; setas apicales de valvulae III lanceoladas (forma de hoja); lóbulo mediano de mesoescudo con 2 pares de setas . . . . . ***E. lanceolata* Evans and Polaszek**

16′ Abdomen completamente amarillo (forma clara) o café obscuro con márgenes laterales, amarillos (forma obscura); setas apicales de valvulae III normales (rectas); lóbulo mediano de mesoescudo con 3–5 pares de setas 17

17 (16) Cuerpo usualmente con una mancha de color café obscuro en forma de triángulo sobre el lóbulo mediano de mesoescudo y abdomen café obscuro con los márgines laterales pálidas (forma oscura); cuerpo a veces completamente amarillo o anaranjado; alas infuscadas debajo de la vena marginal; F5 1.2× mas largo que F4; F6 muy alargado, mucho mas largo que F5. . . . . ***E. tabacivora* Viggiani**

17′ Cuerpo completamente amarillo brillante; alas hialinas, F5 un poco mas largo que F4 y un poco mas corto que F6 . . . . . ***E. telamachusi* Evans, sp. nov.**

18 (15′) Cuerpo completamente amarillo, distancia entre los sensillae placoides del escutelo menor del diámetro que de un sensillum; parte posterior del disco del ala anterior con una área de setas más largas que otras (Fig. 14); lóbulo mediano de mesoescudo usualmente con 4 pares de setas (a veces 3 o 5 pares) . . ***E. sophia* (Girault and Dodd)**

18′ Cuerpo por lo menos parcialmente café obscuro o negro, distancia entre los sensillae placoides variable; setas del ala anterior uniformes; lóbulo mediano de mesoescudo con 4 pares de setas 19

19 (18′) F1 cilíndrico, longitud 0.7× del F2; distancia entre los sensillae placoides del escutelo menor del diámetro de un sensillum; lóbulo mediano del mesoescudo con 4 pares de setas; abdomen café obscuro 20

19′ F1 cuadrado (Fig. 1), distancia entre los sensillae placoides por lo menos 2.5× el diámetro de un sensillum; abdomen amarillo con unas áreas de color café sobre algunos terguitos 21

20 (19) Flagelo amarillo, ala hialina, base del tergito VI de abdomen excepcionalmente ancha . . . . . ***E. portoricensis* Howard**

20′ Flagelo amarillo con F5 y F6 café obscuro; ala ahumada debajo de la vena marginal; tergito VI de abdomen no excepcionalmente ancho . . . . . ***E. catherinae* (Dozier)**

21 (19′) Abdomen amarillo con terguitos IV–VI café obscuro; F1 cuadrado; lóbulo mediano del mesoescudo con 4 pares de setas (Figs. 1–4) . . . . . ***E. dominicana* Evans, sp. nov.**

21′ Abdomen amarillo con terguitos I y II café obscuros; F1 transverso, lóbulo mediano del mesoescudo con 5 pares de setas . . . . . ***E. perplexa* Huang and Polaszek**

Family Aphelinidae

***Cales noacki* Howard**
(Figs. 12, 13, 16, 17)

Cales noacki Howard 1907:82

Hispaniola records.—HAITI, Kenskoff, 5.xi.1929, *ex Aleurothrixus* n. sp. on *Prunus myrtifolia*; Cote Plage, 21.xi.1930 and Port-au-Prince, 18–19.vi.1931, *ex Aleurothrixus floccosus* on mahogany (*Swietenia* sp.); Damien, 21–23.iii.1931, *ex Aleurothrixus* n. sp. on *Catalpa longissima* (Dozier 1933).

Comments.—Traditionally, the genus *Cales* has been placed in the family Aphel-

inidae. Taxonomists have debated this placement (Hayat 1994, Woolley 1997), some suggesting that the genus is better placed in the Trichogrammatidae, while others consider it to be more closely related to the Eulophidae or the Mymaridae. The original host record (*Orthezia*) for this parasitoid species is probably erroneous. We suspect that the sample was contaminated with *Aleurothrixus floccosus* or some other whitefly species. Contrary to Viggiani and Carver's (1988) statement that this species has 1 pair of setae on the scutellum, we found 2 pairs of setae on the scutellum (Fig. 18); one pair of very elongate setae are present along the posterior margin of the scutellum and one pair of very minute setae are located adjacent to the placoid sensillae.

Encarsia catherinae (Dozier)

Trichaporus catherinae Dozier 1933:92

Hispaniola records.—HAITI, Damien, 1 XI 1931, *ex Aleuroplatus* sp. (USNM).

Encarsia cubensis Gahan
(Fig. 19)

Encarsia cubensis Gahan 1931:121.
Trichoporus cubensis (Gahan), Dozier 1933:92.

Hispaniola records.—DOMINICAN REPUBLIC, Azul Province, Las Charcas, 16.i.1995, C. Serra, *ex *Bemisia tuberculata* on *Manihot esculenta*; HAITI, Damien, 6–15.xii.1930, H.L. Dozier, *ex Aleurothrixus floccosus* on *Spondias mombin*; Sarth, 26.i.1931, *ex Aleurothrixus floccosus* on *Guaiacum officinale* (Dozier 1933).

Encarsia dominicana Evans, new species
(Figs. 1–4)

Encarsia brasiliensis (Hempel): misidentification Dozier 1932a:121; Grissell 1979:2.

Type material.—Holotype female, DOMINICAN REPUBLIC, Las Terrenas, iv.1998, C. Serra, *ex Aleurothrixus floccosus*, in United States Natural History Museum, Washington, D.C., USA; 3 female paratypes and 1 female (unemerged, inside the whitefly pupa), same data as holotype.

Diagnosis.—The female of *E. dominicana* is similar to *Encarsia bellottii* Evans and Castillo and can be distinguished from that species which has the gastral tergites I and II dark brown, the F1 antenna segment transverse, and 2 pairs of setae on the mesoscutum. In *E. dominicana*, the gaster is yellow with the central portion of tergites IV, V, and VI entirely dark brown, the F1 antenna segment is quadrate, and there are 4 pairs of setae on the mesoscutum. It is also similar to *Encarsia perplexa* Huang and Polaszek, a species which has often been misidentified as *Encarsia opulenta*, but differs from this species by having the gaster yellow with dark brown tergites IV–VI, F1 quadrate and the Sc1 setae elongate, slightly shorter than Sc2. In *E. perplexa*, the gaster is yellow with posterior edge of tergite II to VI dark brown, F1 is transverse and Sc1 setae is short, less than 0.5 × Sc2.

Description.—Female (Fig. 1). Coloration. Head yellowish with dark brown, transverse band at level of foramen; mesosoma yellow with anterior margin of midlobe and axillae dark brown; legs and antennae yellow; metanotum dark brown; metasoma yellow with tergites IV–VI and apical third of valvulae III dark brown; fore wing hyaline with faint infuscation under marginal vein to posterior margin of wing. Structure. Antenna (Fig. 3) with 3-segmented club, F1–F6 with the following number of linear sensilla: F1:0, F2:2, F3:3, F4:3, F5:3, F6:3. Midlobe of mesoscutum broad, 1.5× as wide as long, with roundish hexagonal reticulations and 4 pairs of setae; each side lobe with 3 setae, each axilla with 1 seta located apically and extending almost to the base of the axilla; scutellum with Sc1 reaching bases of Sc2, distance between placoid sensilla about 3× the width of one sensillum; endophragma reaching middle of gastral tergite I; tibial spur of middle leg (Fig. 2) 0.9× corresponding basitarsus; fore wing

(Fig. 4) broad, disc length 1.0–1.1× disc width; 2–3 basal group setae, marginal vein with 7 long and stout setae along its anterior margin, 2 parastigmal setae at its base, discal setae uniformily distributed; marginal fringe 0.2× disc width; gastral dorsum with imbricate lateral margins on tergites I–IV, becoming weak on tergite V, and stipuled on VI and VII; tergites I–VII with 0, 1, 1, 1, 3, 3, and 2 pairs of setae, respectively; ovipositor arising at center of tergite II, length 1.6–1.7× length of tibia of middle leg; valvulae III length 0.4× that of ovipositor.

Male.—Unknown.

Distribution.—DOMINICAN REPUBLIC; HAITI; USA: Florida.

Host.—Aleurothrixus floccosus.

Hispaniola records (in addition to the holotype).—HAITI, Kenskoff, 5–8.xi.1929, *ex Aleurothrixus* n. sp., on *Prunus myrtifolia;* Damien, 15.xii.1930, *ex Aleurothrixus floccosus* on *Spondias mombin* (Dozier 1932a).

Etymology.—This species is named for the people of the Dominican Republic.

Comments.—Dozier (1932a) redescribed *Encarsia brasiliensis* (Hempel) based upon the specimens from Haiti mentioned above. The original description of this species by Hempel (1904) states that *E. brasiliensis* is entirely yellow and has a 4-segmented tarsus on the middle leg. Hempel's species is a member of the *Encarsia luteola* species group and will be redescribed elsewhere from topotypical specimens by Polaszek and Evans.

Encarsia formosa Gahan

Encarsia formosa Gahan 1924:14.

Hispaniola records.—*DOMINICAN REPUBLIC, La Vega Province, Constanza, 1992, S. Tappertzhofen, *ex* whitefly on *Euphorbia pulcherrima;* Santiago Province, La Herradura, 4.iv. 1995, C. Serra, *ex Bemisia tabaci* complex, on *Euphorbia pulcherrima;* La Vega Province, El Rio, Constanza, 25.v.95, C. Serra, *ex Trialeurodes vaporiorarum* on *Manihot esculenta.*

Encarsia haitiensis Dozier

Encarsia haitiensis Dozier 1932a:118.

Hispaniola records.—Holotype female, HAITI, Damien, 15.xii.1930, H.L. Dozier, *ex Aleurothrixus floccosus* on *Spondias mombin,* in USNM; HAITI, Sarthe, 16.i.1931, *ex Aleurothrixus floccosus* on *Guaicum officinale* (Dozier 1933).

Encarsia hispida De Santis

Encarsia hispida De Santis 1948:47.

Hispaniola record.—DOMINICAN REPUBLIC, *ex Bemisia tuberculata* on *Manihot esculenta,* x.1991, P. Stansly (Polaszek *et al.* 1992:383).

Encarsia lanceolata Evans and Polaszek

Encarsia lanceolata Evans and Polaszek 1997:564.

Hispaniola records.—*DOMINICAN REPUBLIC, Samaná Province, Puerto Escondido, 22.vi.1996, C. Serra, *ex Bemisia tabaci* on unknown plant; Santiago Province, La Herradura, C. Serra, *ex *Aleurodicus* sp. on ornamental palm (probably *Sabal* sp.); C. Serra, *ex Tetraleurodes acaciae* on *Centrosema pubescens.* *HAITI, Morno a Cabrito, 22.xii.1930, H. L. Dozier, *ex Paraleyrodes* or *Tetraleurodes* sp.

Encarsia nigricephala Dozier

Encarsia nigricephala Dozier 1937:129.

Hispaniola records.—DOMINICAN REPUBLIC, San Cristobal Province, San Cristobal, 15.v.1990, C. Serra, *ex Aleurotrachelus* sp. on *Lycopersicon esculentum;* Santiago Province, La Herradura, Santiago, 13.vi. 1995, C. Serra, *ex Aleurotrachelus trachoides* on *Capsicum annuum;* San Jose de las Matas, 26.xi.1995, C. Serra, *ex Bemisia tabaci* complex on *Sida* sp.; Peravia Province, Bani, 16.iv.1995, C. Serra, *ex Aleurotrachelus trachoides* on *Merremia* sp.

Encarsia perplexa Huang and Polaszek

Encarsia perplexa Huang and Polaszek 1998: 1934.

Prospaltella opulenta Silvestri; Grissell 1979:2 misidentification.
Encarsia opulenta (Silvestri); Schauff *et al.* 1996: 23 misidentification.

Hispaniola records.—DOMINICAN REPUBLIC. *E. perplexa* (as *E. opulenta*), introduced into the Dominican Republic in 1996, was very efficient in controlling citrus blackfly (A. Abud, personal communication).

Comments.—*Encarsia perplexa* has often been misidentified as *Encarsia opulenta* (Silvestri), especially those specimens from the New World. According to Huang and Polaszek (1998), the midlobe of *E. perplexa* is dark only proximally, T1 and T2 of gaster are largely pale and F2 is less than 2× as long as wide; as opposed to *E. opulenta*, which has the midlobe, T1 and T2 completely dark brown, and F2 more than 2× as long as wide.

Encarsia portoricensis Howard

Encarsia portoricensis Howard 1907:77.

Hispaniola records.—DOMINICAN REPUBLIC (De Santis 1979). New Record: Samaná Province, Las Terrenas, iv.1995, C. Serra, *ex Aleuroglandulus malangae* on *Xanthosoma sagittifolium* and *Caladium* sp.

Comments.—Russell (1934) reported this species as a parasitoid of the diaspine scale, *Comstockiella sabalis* (Comstock). Evans and Pedata (1997) considered this record to be an erroneous identification of the male of *Coccobius donatellae* Pedata and Evans.

Encarsia sophia (Girault and Dodd)
(Fig. 14)

Coccophagus sofia Girault and Dodd 1915:49.
Encarsia transvena (Timberlake), See Heraty and Polaszek (2000) for complete synonymy.

Hispaniola records.—DOMINICAN REPUBLIC, Santiago Province, San Jose de las Matas, 15 vii 96, M. Ortiz, ex-*Trialeurodes vaporariorum* on *Phaseolus vulgaris*; Santiago Province, La Herradura, *ex Aleurodicus dispersus* on ornamental; Santiago, 24.iv.1995, C. Serra, *ex Bemisia tuberculata* on *Manihot esculenta*; La Vega Province, Jarabacoa, 13.vi.1995, C. Serra, *ex Bemisia tabaci* complex on *Brassica oleracea*.

Encarsia tabacivora Viggiani

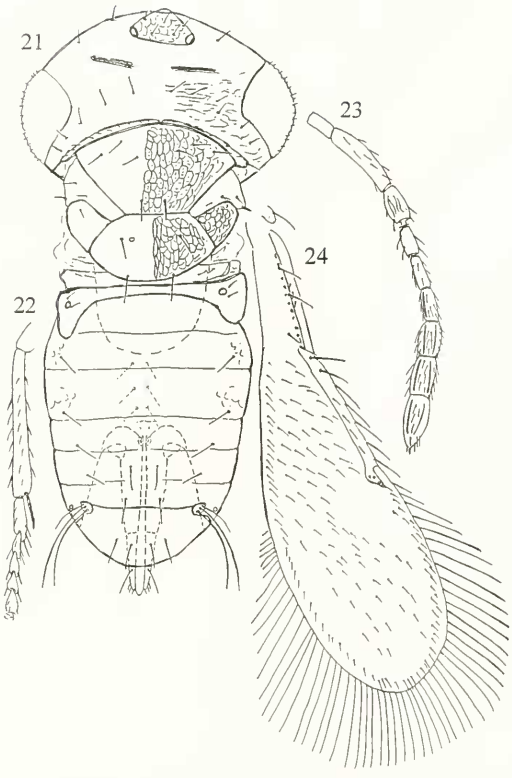
Encarsia bemisiae De Santis 1981:37 (name preoccupied by *Prospaltella bemisiae* Ishii).
Encarsia tabacivora Viggiani 1985:82.

Hispaniola records.—*DOMINICAN REPUBLIC, Santiago Province, San Jose de las Matas, 5.vi.1996, C. Serra, *ex Bemisia tabaci* on *Baccharis sativas*; Santiago Province, La Herradura, *ex Bemisia tabaci* on *Solanum melongena*; La Herradura, *ex Aleurodicus* sp. on ornamental palm (probably *Sabal* sp.); La Herradura, 18.ii.1995, *ex Trialeurodes vaporariorum*; Peravia Province, Los Ranchitos, i.1994, S. Tappertzhofen, *ex* whitefly on *Solanum melongena*; San Cristobal Province, San Cristobal, ix.1993, S. Tappertzhofen, yellow trap; La Vega, Jarabacoa (>500 masl), 18.i.1996, C. Serra, *ex Bemisia tabaci* and *Trialeurodes vaporiorarum* on *Gerbera* sp.; Azua Province, La Cabuya, I.1994, S. Tappertzhofen, yellow trap and ix.1993, whitefly on *Solanum melongena*; Santiago, La Herradura, 18.ii.1995, C. Serra, *ex Bemisia tabaci*.

Encarsia telemachusi Evans, new species
(Figs. 21–24)

Type material.—Holotype female, HAITI, Source, Cazeau, 25.xii.1930, H. L. Dozier, *ex "Asterochiton bauhiniae" [=Trialeurodes floridensis?]*, on *Bauhinia divaricata*, in United States Natural History Museum, Washington, D.C., USA; 2 female paratypes, same data as holotype.

Diagnosis.—The female of *E. telemachusi* is similar to the light form of *E. tabacivora* Viggiani and can be distinguished by having a bright yellow body, hyaline fore wing and F5 slightly longer than F4 and slightly shorter than F6; in the light form of *E. tabacivora*, the body a darker yellow, with tergite VI slightly infuscate, the fore



Figs. 21–24. *Encarsia telemachusi*, female, 21, Habitus. 22, Tibia and tarsus, leg II. 23, Antenna. 24, Fore wing.

wing is infuscate under the marginal vein and F5 is distinctly (1.2×) longer than F4 and much shorter than F6.

Description.—Female. Coloration (Fig. 21). Body bright yellow, fore wing hyaline. Structure. Antenna (Fig. 23) with 3-segmented club, F1–F6 with the following number of linear sensilla: F1:0, F2:0, F3:2, F4:3, F5:3, F6:3. Midlobe of mesoscutum broad, 1.8× wider than long, with elongate, hexagonal reticulations and 4 pairs of setae; setae on side lobes not visible, each axilla with 1 short seta located apically; scutellum with Sc1 moderate in length and not reaching bases of Sc2, distance between placoid sensilla about 5× the width of one sensillum; endophragma reaching middle of gastral tergite II; tibial spur of middle leg (Fig. 22) 0.75× corresponding basitarsus; fore wing (Fig. 24) broad, disc length 1.3× disc width; 3 short costal setae along anterior margin of submarginal vein; 2 basal group setae; submarginal vein with 2 setae; marginal vein with 6 setae along its anterior margin, 2 parastigmal setae at its base, fore wing discal setae sparse with a large asetose area under the stigmal vein and posterior margin; marginal fringe 0.7× disc width; gastral tergite VI with 1 pair of setae between cerci; ovipositor arising at center of tergite IV, length 1.1× length of tibia of middle leg; valvulae III length 0.3× that of ovipositor.

Male.—Unknown.

Distribution.—HAITI.

Host.—*?Trialeurodes floridensis.*

Hispaniola records.—Known from the type locality only.

Etymology.—This species is named in honor of Telemachus, a monk from Asia Minor, who stood alone in opposition to the gladiator games held in Rome in 400 A.D., and whose death on the gladiator field brought about the end of the games in 404 A.D.

Comments.—The identity of the whitefly species from which this parasite emerged is uncertain. H. L. Dozier recorded its host as "*Asterochiton bauhiniae*". This name does not appear in Mound and Halsey's 1978 whitefly catalog; therefore, we assume that it is an invalid name. Of the eleven aleyrodine species Mound and Halsey (1978) list as found on *Bauhinia*, only two species, *Trialeurodes floridensis* (Quaintance) and *Bemisia tabaci* (Genn.), are known to occur in the New World. In addition, a search of the collection records stored in the whitefly database of the Florida State Collection of Arthropods, Gainesville, Florida yielded only one species, *Tetraleurodes acaciae* (Quaintance), that has been found on this host in Florida and Puerto Rico. The genus *Tetraleurodes* is very distinct from *Asterochiton*, and it is unlikely that Dozier would have confused these two genera. Steven Nakahara (USDA, personal communication) report-

ed that "there is no slide or dry material of *Asterochiton bauhiniae* in the USDA collection, and that this is probably a manuscript name. Most species previously placed in *Asterochiton* in the New World are placed in *Trialeurodes*". Therefore, it is likely that the true identity of the host of this parasite is *Trialeurodes floridensis*.

Encarsia variegata Howard

Encarsia variegata Howard 1908:64.
Trichoporus variegata (Howard), Dozier 1933:92.

Hispaniola records.—HAITI, Port-au-Prince and Source Cazeau, H.L. Dozier, *ex Paraleyrodes* sp. on *Citrus* sp. (Dozier 1933).

Eretmocerus pallidus Dozier

Eretmocerus pallidus Dozier 1932b:116.

Hispaniola record.—Holotype female, HAITI, Port-au-Prince, 11–17.iv.1931, *ex Tetraleurodes* n. sp. on *Annona squamosa* (USNM).

Comments.—This species was described from 42 females and is apparently uniparental.

Eretmocerus portoricensis Dozier

Eretmocerus portoricensis Dozier 1932b:115; Rose and Zolnerowich 1997:18.

Hispaniola record.—DOMINICAN REPUBLIC, *ex Aleurothrixus floccosus* (De Santis 1979).

Comments.—This species was described from 45 females and is apparently uniparental.

Eretmocerus serius Silvestri

Eretmocerus serius Silvestri 1928:46.

Hispaniola record.—Dozier (1932c) reported on the introduction of this species into Haiti in 1931. Specimens were sent from Cuba and released in Port-au-Prince for the control of *Aleurocanthus woglumi* on citrus. A second shipment of this parasite was released in the cities of Petionville, Turgeau and Thor.

Comments.—This species has not been recovered in subsequent collections which suggests that it may have been displaced by *Encarsia perplexa* Huang and Polaszek (=misidentification of *E. opulenta*) and/or *Amitus hesperidum* Silvestri in most areas where *Aleurocanthus woglumi* occurs.

Eretmocerus spp.

Hispaniola specimens.—1 female, DOMINICAN REPUBLIC, x.1991, *ex ?Aleurothrixus floccosus* on *Manihot esculenta*; one male specimen, DOMINICAN REPUBLIC, La Vega, Jarabacoa, 10.xii.1995, C. Serra and M. Ortiz, *ex Trialeurodes vaporariorum* and *Bemisia tabaci*, on *Gerbera* sp.; four females, DOMINICAN REPUBLIC, Santiago Province, La Herradura, 18.ii.1995, C. Serra, *ex Bemisia tabaci* complex; HAITI, Damien, 17.vi.1939, *ex Aleurothrixus floccosus* on *Guaiacum officinarum*; 1 female, *ex Aleuroclava minutus* on *Ixora coccinea* in DOMINCAN REPUBLIC, Santiago Province, Santiago, 19.i.1997, C. Serra; DOMINICAN REPUBLIC, Ocoa, Los Ranchitos, Sabine Tappertrzhofen, whitefly on *Solanum melongena*; DOMINICAN REPUBLIC, Ocoa, Las Carreras, Sabine Tappertrzhofen, whitefly on *Solanum melongena*; DOMINICAN REPUBLIC, Azua, Proy, Sabine Tappertrzhofen, whitefly on *Lycopersicon esculentum*.

Family Eulophidae

Neopomphale aleurothrixi (Dozier)
(Figs. 6, 20)

Eudecomphale aleurothrixus Dozier 1932a:120.
Neopomphale aleurothrixi (Dozier), Schauff and LaSalle (1994).

Hispaniola records.—Holotype female, HAITI, Sarthe, 3–4.ii.1931, *ex Aleurothrixus floccosus* on *Guaiacum offinale*, in USNM; DOMINICAN REPUBLIC, Monte Plata Province, Cruz Verde, 25.ix.1996, C. Serra, *ex Aleurothrixus floccosus* on *Citrus sinensis* and *C. aurantium*.

Table 1. Parasitoids associated with whiteflies in Hispaniola.

Aleurocanthus woglumi Ashby: *Encarsia perplexa, Eretmocerus serius*
Aleuroclava minutus (Singh): *Eretmocerus* sp.
Aleurodicus dispersus Russell: *Encarsia sofia*
Aleurodicus sp.: *Encarsia lanceolata*
Aleuroglandulus malangae Russell: *Encarsia hispida, Encarsia portoricensis*
Aleuoplatus sp.: *Encarsia catherinae*
Aleurothrixus floccosus (Maskell): *Cales noacki, Encarsia cubensis, Encarsia dominicana, Encarsia haitiensis, Encarsia variegata, Eretmocerus portoricensis, Eretmocerus* sp., *Neopomphale aleurothrixi, Signiphora townsendi* (hyperparasitoid)
Aleurotrachelus trachoides (Back): *Encarsia nigricephala*
Bemisia tabaci (Genn.)—*complex*: *Encarsia hispida, Encarsia lanceolata, Encarsia tabacivora, Eretmocerus* sp., *Signiphora aleyrodis* (hyperparasitoid)
Bemisia tuberculata Hempel: *Encarsia cubensis, Encarsia hispida, Encarsia sofia*
Paraleyrodes naranjae Dozier: *Encarsia variegata*
Paraleyrodes perseae (Quaintance): *Encarsia variegata*
Tetraleurodes sp.: *Eretmocerus pallidus*
Trialeurodes floridensis? (Quaintance): *Encarsia telemachusi*
Trialeurodes vaporariorum (Westwood): *Amitus fuscipennis, Encarsia formosa, Encarsia hispida, Encarsia tabacivora*
Unidentified aleyrodid: *Eretmocerus* sp.

Family Signiphoridae

Signiphora aleyrodis Ashmead
(Figs. 9, 15, 18)

Signiphora aleyrodis Ashmead 1900:412.

Hispaniola record.—DOMINICAN REPUBLIC, Azua Province, La Cabuya, S. Tappertzhofen, yellow trap (a hyperparasite through whitefly species).

Signiphora townsendi Ashmead
(Figs. 10, 11)

Signiphora townsendi Ashmead 1900:412.

Hispaniola record.—DOMINICAN REPUBLIC, Santiago Province, La Herradura, C. Serra 6.vi.95, *ex Aleurothrixus floccosus* on *Psidium guajava* (a hyperparasite).

Family Platygastridae

Amitus fuscipennis MacGown and Nebeker
(Fig. 5)

Amitus fuscipennis MacGown and Nebeker 1978; Viggiani 1991 (redescription).

Hispaniola records.—DOMINICAN REPUBLIC, Cord Central, 17.viii.1972 (MacGown and Nebeker 1978); DOMINICAN REPUBLIC, La Vega Province, Arroyo Prieto, Constanza, 16.v.1995, C. Serra, *ex Trialeurodes vaporariorum* on tomato, *Lycopersicon esculentum*; La Vega Province, Tubuagua, C. Serra, 16.v.1995, *ex Bemisia tabaci* complex and/or *Aleurotrachelus* sp., on *Lycopersicon esculentum*; Sabaneta, Jarabacoa, 13.vi.1995, C. Serra, *T. vaporariorum* on *Helianthus annuus*.

DISCUSSION

The parasitoid complex reared from the various whitefly species in Hispaniola is similar to that found in several other Neotropical countries. Most of the parasitoid species attacking *Aleurothrixus floccosus* have a very narrow host range; most of them are only known from this species and few are known to attack relatively few alternate hosts. *Amitus fuscipennis* occurs in Florida and several Neotropical countries and is often reared from the greenhouse whitefly, *Trialeurodes vaporariorum*, as is *Encarsia formosa* which has been introduced into many areas of the world. *Encarsia hispida, E. lanceolata, E. nigricephala, E. sofia* and *E. tabacivora* are very widespread and are known to parasitize various whitefly hosts; with the exception

of *Encarsia luteola*, which has not been found in Hispaniola, these species comprise the majority of the parasitoids reared from the *Bemisia tabaci* complex in the New World.

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